

February 2012

SUSB42

FSUSB42 — Low-Power, Two-Port, Hi-Speed, USB2.0 (480Mbps) UART Switch

Features

FAIRCHILD SEMICONDUCTOR

- Low On Capacitance: 3.7pF Typical
- Low On Resistance: 3.90 Typical
- Low Power Consumption: 1µA Maximum – 15µA Maximum I_{CCT} over an Expanded Voltage Range (V_{IN} =1.8V, V_{CC} =4.4V)
- Wide -3db Bandwidth: > 720MHz
- Packaged in:
 - 10-Lead UMLP (1.4 x 1.8mm)
 - 10-Lead MSOP
- 8kV ESD Rating, >16kV Power/GND ESD Rating
- Over-Voltage Tolerance (OVT) on all USB Ports Up to 5.25V without External Components

Applications

- Cell phone, PDA, Digital Camera, and Notebook
- LCD Monitor, TV, and Set-Top Box

IMPORTANT NOTE:

For additional performance information, please contact analogswitch@fairchildsemi.com.

Description

The FSUSB42 is a bi-directional, low-power, two-port, Hi-Speed, USB2.0 switch. Configured as a double-pole, double-throw switch (DPDT) switch, it is optimized for switching between two Hi-Speed (480Mbps) sources or a Hi-Speed and Full-Speed (12Mbps) source.

The FSUSB42 is compatible with the requirements of USB2.0 and features an extremely low on capacitance (CON) of 3.7pF. The wide bandwidth of this device (720MHz) exceeds the bandwidth needed to pass the third harmonic, resulting in signals with minimum edge and phase distortion. Superior channel-to-channel crosstalk also minimizes interference.

The FSUSB42 contains special circuitry on the switch I/O pins for applications where the V_{CC} supply is powered-off (V_{CC}=0), which allows the device to withstand an over-voltage condition. This device is designed to minimize current consumption even when the control voltage applied to the SEL pin is lower than the supply voltage (V_{CC}). This feature is especially valuable to ultra-portable applications, such as cell phones, allowing for direct interface with the generalpurpose I/Os of the baseband processor. Other applications include switching and connector sharing in portable cell phones, PDAs, digital cameras, printers, and notebook computers.

Ordering Information

Part Number	Top Mark	Operating Temperature Range	Package
FSUSB42UMX	HE	-4010 +85 0	10-Lead, Quad, Ultrathin Molded Leadless Package (UMLP), 1.4 x 1.8mm
FSUSB42MUX	FSUSB42	-40 to +85°C	10-Lead, Molded Small Outline Package (MSOP) JEDEC MO-187, 3.0mm Wide

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Pin Definitions

UMLP Pin#	MSOP Pin#	Name	Description	
1	3	D+	USB Data Bus	
2	4	D-	USB Data Bus	
3	5	GND	Ground	
4	6	HSD1-	Multiplexed Source Inputs (UART / USB)	
5	7	HSD1+	Multiplexed Source Inputs (UART / USB)	
6	8	HSD2-	Multiplexed Source Inputs (USB Only)	
7	9	HSD2+	Multiplexed Source Inputs (USB Only)	
8	10	/OE	Switch Enable	
9	1	V _{CC}	Supply Voltage	
10	2	Sel	Switch Select	

Truth Table

Sel	/OE	Function
Х	HIGH	Disconnect
LOW	LOW	D+, D-=HSD1+, HSD1-
HIGH	LOW	D+, D-=HSD2+, HSD2-

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	Parameter		Min.	Max.	Unit
Vcc	Supply Voltage		-0.5	5.6	V
V _{CNTRL}	DC Input Voltage (S, /OE) ⁽¹⁾		-0.5	Vcc	V
Vsw	DC Switch I/O Voltage ⁽¹⁾		-0.50	5.25	V
I _{IK}	DC Input Diode Current		-50		mA
lout	DC Output Current			100	mA
T _{STG}	Storage Temperature	-65	+150	°C	
MSL	Moisture Sensitivity Level (JEDEC J-STD-020		1	Level	
		All Pins	7		
	Human Body Model, JEDEC: JESD22-A114	I/O to GND	8		
		Power to GND	16		
ESD		D+/D-	9		kV
	IEC 61000-4-2 System on USB Connector	Air Discharge	15		
	Pins D+ & D-	Contact	8		
	Charged Device Model, JEDEC: JESD22-C10)1	2		

Note:

1. The input and output negative ratings may be exceeded if the input and output diode current ratings are observed.

Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. Fairchild does not recommend exceeding them or designing to Absolute Maximum Ratings.

Symbol	Parameter	Min.	Max.	Unit
Vcc	Supply Voltage	3.0	4.4	V
V _{CNTRL} ⁽²⁾	Control Input Voltage (S, /OE)	0	Vcc	V
V _{SW}	Switch I/O Voltage	-0.5	4.5	V
T _A	Operating Temperature	-40	+85	°C

Note:

2. The control input must be held HIGH or LOW and it must not float.

DC Electrical Characteristics

All typical value are at T_A =25°C unless otherwise specified.

Cumbal	Devementer	Condition		T _A =- 40°C to +85°C			Unit
Symbol	Parameter	Condition	V _{cc} (V)	Min.	Тур.	Max.	Unit
V _{IK}	Clamp Diode Voltage	I _{IN} =-18mA	3.0			-1.2	V
V	Input Voltago High		3.0 to 3.6	1.3			V
V _{IH}	Input Voltage High		4.3	1.7			V
V	Input Voltage Low		3.0 to 3.6			0.5	V
V _{IL}	Input Voltage Low		4.3			0.7	V
l _{in}	Control Input Leakage	V _{sw} =0 to V _{cc}	0 to 4.3	-1		1	μA
I _{oz}	Off State Leakage	$0 \le Dn$, HSD1n, HSD2n $\le 3.6V$	4.3	-2		2	μA
IOFF	Power-Off Leakage Current (All I/O Ports)	V_{SW} =0V to 4.3V, V _{CC} =0V Figure 5	0	-2		2	μA
R _{on}	HS Switch On Resistance ⁽³⁾	V _{SW} =0.4V, I _{ON} =-8mA Figure 4,	3.0		3.9	6.5	Ω
ΔR_{ON}	HS Delta R _{ON} ⁽⁴⁾	V _{SW} =0.4V, I _{ON} =-8mA	3.0		0.65		Ω
I _{CC}	Quiescent Supply Current	V _{CNTRL} =0 or V _{CC} , I _{OUT} =0	4.3			1	μA
	Increase in I _{cc} Current per	V _{CNTRL} =2.6V, V _{CC} =4.3V	4.3			10	μA
I _{CCT}	Control Voltage and V _{CC}	V _{CNTRL} =1.8V, V _{CC} =4.3V	4.3			15	μA

Notes:

3. Measured by the voltage drop between HSDn and Dn pins at the indicated current through the switch.

On resistance is determined by the lower of the voltage on the two (HSDn or Dn ports).

4. Guaranteed by characterization.

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AC Electrical Characteristics

All typical value are for V_{CC} =3.3V at T_A=25°C unless otherwise specified.

Symbol	Parameter	Condition		T _A =- 40°C to +85°C			Unit
Symbol	Parameter	Condition	V _{cc} (V)	Min.	Тур.	Max.	Unit
t _{on}	Turn-On Time S, /OE to Output	R_L =50 Ω , C_L =5pF V _{SW} =0.8V Figure 6, Figure 7	3.0 to 3.6		13	30	ns
t _{OFF}	Turn-Off Time S, /OE to Output	R_L =50 Ω , C_L =5pF V _{SW} =0.8V Figure 6, Figure 7	3.0 to 3.6		12	25	ns
t _{PD}	Propagation Delay ⁽⁵⁾	$C_L=5 \text{ pF}, R_L=50\Omega$ Figure 6, Figure 8	3.3		0.25		ns
t _{ввм}	Break-Before-Make	$\begin{array}{l} R_{L} {=} 50\Omega, \ C_{L} {=} 5pF \\ V_{SW1} {=} V_{SW2} {=} 0.8V \\ Figure 10 \end{array}$	3.0 to 3.6	2.0		6.5	ns
O _{IRR}	Off Isolation	R_L =50 Ω , f=240MHz Figure 12	3.0 to 3.6		-30		dB
Xtalk	Non-Adjacent Channel Crosstalk	R _L =50Ω, f=240MHz Figure 13	3.0 to 3.6		-45		dB
BW	-3db Bandwidth	R_L =50 Ω , C_L =0pF Figure 11	- 3.0 to 3.6		720		MHz
DVV		R_L =50 Ω , C_L =5pF Figure 11			550		MHz

Note:

5. Guaranteed by characterization.

USB Hi-Speed-Related AC Electrical Characteristics

Cumbal	Devementer	Qan ditian	V 00	T _A =- 40°C to +85°C			Unit
Symbol	Parameter	Condition	V _{cc} (V)	Min.	Тур.	Max.	Unit
t _{SK(P)}	Skew of Opposite Transitions of the Same Output ⁽⁶⁾	C∟=5pF, R∟=50Ω Figure 9	3.0 to 3.6		20		ps
tj	Total Jitter ⁽⁶⁾	R _L =50Ω, C _L =5pf, t _R =t _F =500ps (10-90%) at 480Mbps (PRBS=2 ¹⁵ – 1)	3.0 to 3.6		200		ps

Note:

6. Guaranteed by characterization.

Capacitance

Cumbal	Deremeter	Condition	T _A =- 40°C to +85°C			
Symbol	Parameter	Condition	Min.	Тур.	Max.	Unit
C _{IN}	Control Pin Input Capacitance	V _{CC} =0V		1.5		
C _{ON}	D+/D- On Capacitance	V _{CC} =3.3V, /OE=0V, f=240MHz Figure 15		3.7		pF
C _{OFF}	D1n, D2n Off Capacitance	V _{CC} and /OE=3.3V Figure 14		2.0		



SW



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